DCR Responses to Questions from the Forest Futures Technical Steering Committee

1. Taking as a starting point the presumption that public lands should be dedicated to providing goods and services that are not adequately provided by owners of private forest land, please discuss DCR's rationale for continued commercial timber harvests on state parks and forests?

    a. Early successional habitat and wildlife diversity – MA Wildlife Action Plan (WAP) pages 308-319 for a detailed discussion of the need for early successional habitat. The MA WAP was one of only 5 of 50 state plans chosen by the Duke Foundation for funding to support implementation due to the exemplary work in the plan. According to the WAP, there is less early successional habitat now than in pre-colonial times and the current amount is decreasing. Forestry is highlighted in the WAP as an important method to create this habitat that is important to many "habitat specialists" such as the New England Cottontail and the Chestnut-sided Warbler (WAP page 309) as well as several other endangered and declining species of reptiles, birds, mammals, birds and insects. A key question for TSC discussion is what is the habitat goal for state lands – is it the mix of habitat that studies indicate were here in pre-colonial times or a mix of habitat that supports viable populations of native wildlife species that exist now. The WAP (page 308) states: "While it is instructive to examine the historical range of variability associated with natural disturbance regimes (see Thompson and DeGraaf 2001), managers should not seek to re-establish conditions from a previous time (e.g. prior to European settlement), but rather should seek to secure a range of conditions in today's landscape that will support viable populations of native wildlife species (DeGraff and Yamasaki 2003)." An excellent literature review of "scrub-shrub" bird ecology has recently been published by Schlossberg and King (2007). This reiterates that early successional habitat is declining as are the bird species associated with this habitat. For example, 21 species have shown short or long-term declines in New England and scrub-shrub declining bird species outnumber non-declining species by a ratio of 3:1. Early successional bird species tend to disappear from clearcuts by 5-15 years after logging. Most scrub-shrub birds avoid edges and prefer patches of 2.5-10 acres. The authors recommend: create more scrub-shrub habitat, especially in southern New England; ensure a variety of habitats – not just clear cuts; and patches should be irregular and at least 2.5 acres in size.

    In order to evaluate current recommendations for management of early-successional habitats, it is prudent to consider how wildlife species that utilize these habitats endured during pre-colonial times. Prior to European colonization of New England, native wildlife species dependent on extensive (2.5-10 ac) patches of open, herb/shrub dominated habitat relied on natural disturbance processes that either removed patches of mature forest canopy, or prevented such canopies from developing. Flooding, fire, and wind events all likely contributed to creation of ephemeral early-successional habitats.

    Flooding was caused across the entire landscape by both extensive beaver activity along low gradient streams, and by spring snow melt and ice breakup along higher gradient streams and rivers that scoured riparian corridors with enough regularity to maintain open habitats. Fire also appears to have been an important source of early-successional habitats, but natural fire appears to have been restricted primarily to extensive fire-

adapted pitch pine/scrub oak ecosystems (Foster et al. 2002a). While there remains controversy surrounding the extent of fire-maintained open woodlands with early-successional characteristics in other upland oak forests (Forman and Russell 1983, Meyers and Peroni 1983, Russell 1983), historical and palynological evidence is consistent with such areas having at least occurred near native American habitation along the coast and rivers (Patterson and Sassaman 1988) and in the uplands near major river drainages (Byers 1946), such as the Connecticut, Merrimack, and Nashua rivers. In all of these areas, Native Americans appear to have used intentional extensive dormant-season fires to maintain semi-open habitats which provided edible fruits and attracted wild game (Bromley 1935). While it appears that most wind events created small gap openings of insufficient size to maintain extensive open habitats, occasional major wind storms likely destroyed continuous areas of mature forest canopy to the benefit of early-successional wildlife species. Overall, flooding appears to have been a continuous source of early-successional habitats throughout the landscape, fire apparently was a frequent source in areas where it occurred, and extensive canopy-replacing wind events were a relatively infrequent source of early-successional habitats across the landscape.

Following European colonization of southern New England, an ecologically ironic situation developed where humans simultaneously eliminated or substantially restricted the dynamic natural disturbance processes of flooding and fire that had for centuries provided continuous sources of extensive early-successional habitats, and at the same time humans artificially replaced these natural open habitats through massive conversion of old-growth forest to agriculture. Fur traders extirpated beaver from southeastern Massachusetts by 1635 and from all but the northern Berkshires of western Massachusetts by 1700, and beaver did not begin re-colonizing the state until the 1920's (Foster et al. 2002b). Early European settlers hayed natural meadows along rivers that were kept open from periodic ice scouring associated with spring flood events, but as forest was converted to agriculture, farmers constructed hundreds of dams to control floodwaters for raising crops, and to harness water power for processing crops. While the combination of beaver extirpation and human dam construction eliminated substantial amounts of natural, open habitats for wildlife, the emergent agrarian landscape of the 18th and early 19th centuries, and subsequent abandonment of agricultural activities across that landscape during the late 19th and early 20th centuries actually provided substantially more early-successional habitat for wildlife than had previously occurred via natural disturbance regimes prior to European colonization.

Human land use change shifted the primary source of early-successional habitats from along riparian corridors where flooding had consistently occurred to more upland situations where old-growth forest had previously occurred. Many native wildlife species that had evolved to exploit extensive disturbance patches apparently were adaptable enough to shift from natural, riparian-based sites to more artificial upland sites. Habitat structure (i.e., extensive, open, herb/shrub dominated environments) appears to be a more important element than location (riparian vs. upland) in site selection for many early-successional wildlife species.

As a result of this adaptive nature, early-successional wildlife species achieved and maintained substantially higher population levels during the 19th and early 20th centuries

than had occurred during the centuries prior to European colonization. Declines in early-successional wildlife populations were inevitable as forest eventually reclaimed abandoned agricultural lands, and this decline was coupled with population recoveries of forest-dependent species like wild turkey, black bear, and native song birds dependent on extensive, closed-canopy forest such as black-throated blue, and black-throated green warblers. The problem faced by early-successional wildlife species during the late 20th and early 21st century is that extensive human-created areas of open habitat have largely faded from the landscape without the adequate restoration of natural disturbance processes of flooding and fire. As a result, population declines of many early-successional wildlife species continue unabated, and active habitat management is needed to stem these long-term declines. Wildlife managers do not advocate returning populations of early-successional wildlife species to the artificially high levels formerly associated with the abandoned agrarian landscape, but rather seek to level-off continuing declines in order to maintain early-successional wildlife species as a secure component of a diverse wildlife community in the 21st century.

The overriding issue is that humans have historically focused development along riparian corridors where natural disturbance processes formerly provided open, early-successional habitats. The approximately 3000 dams that occur in Massachusetts today help protect development from flood waters but curtail the dynamic natural process of spring flooding that formerly scoured open habitats along many riparian areas. And while it is true that beaver have made a substantial recovery in Massachusetts, their impact on habitat remains limited relative to pre-colonial times because humans now occupy many of the low-gradient riparian sites historically preferred by beaver, and constant problems occur with beaver flooding well fields, septic fields, and buildings. These beaver are invariably trapped or shot, as are other beaver that plug road culverts and construct dams that threaten to flood portions of the human transportation infrastructure. Every beaver flowage that is eliminated or altered to prevent water damage to human infrastructure eliminates areas of potential high quality early-successional wildlife habitat. To be sure, beaver do provide some high quality habitat today for early-successional wildlife species, but this vital habitat component is now and will remain quite limited compared to what it was during pre-colonial times (see the Massachusetts WAP for more details on this subject).

The presence of human-built dams along high gradient streams and rivers coupled with human-imposed restrictions on beaver activities along low gradient streams severely limit the amount of early-successional habitat provided by the dynamic natural disturbance process of flooding. In addition, human fire suppression throughout the extensive pitch pine/scrub oak ecosystems of southeastern Massachusetts and conversion of these ecosystems to building lots elsewhere in the state limits another important source of early-successional habitat. Wind storms, ice storms, and insect outbreaks do continue to disrupt forest canopies, but do not routinely create adequate patch areas for early-successional wildlife species that benefit from 2-10 contiguous acres of open habitat.

Even the most damaging ice storm in recent human memory that occurred across central Massachusetts in December 2008 did not create the extensive patches of open habitat preferred by many declining early-successional wildlife species. While tree

crown damage was extensive in many places, most damaged trees will survive and the resulting canopy gaps caused by the ice storm are typically not nearly large enough to provide the 2-10 acre habitat patches that are so beneficial to many declining wildlife species.

b. Uneven aged forests and these carbon sequestration benefits and aesthetics– uneven aged forests were widespread in our original forests but extremely rare today. For example, Sewall analysis of 2003 aerial photos of DCR land found that 4% of the DCR DSPR land was uneven aged – containing 3 or more age classes in a mosaic. This analysis was at a 90% accuracy. Transitioning our even aged forests to an uneven aged condition takes several carefully planned harvests that are not likely to occur on private lands due to short ownership patterns. Although additional information is needed for carbon sequestration recommendations for forestry, emerging information developed by the Forest Guild, New England Forestry Foundation, Manomet Center for Conservation Sciences, University of Vermont and the Wildlands and Woodlands initiative indicate a role for uneven aged forests in climate mitigation by holding more volume per acre, especially when paired with approaches that thin the forest for increased growth and vigor, extend rotations, promote full stocking and forest vigor, lower vulnerability to catastrophic losses and retain forest structure during harvests. For example, William Keeton of the University of VT estimates that using less intensive forestry, a forest can store and accumulate 91% of the carbon of an old growth forest (see publications by William Keeton of Univ. of VT).

c. Support of local forest jobs – while the Inter-state Commerce Clause limits what individual states can do as far as in-state product preferences, the Global Warming Solutions Act may offer ways for the state to extend preferences for forest products that are produced near the harvest site (whether just over the state boundary or in-state due to the reduced carbon footprint of local products).

d. Higher forestry standards as a demonstration to private forest owners – There is a delicate balancing needed with forest cutting regulations. Currently, MA has among the strictest regulations in the country. Increasing regulation makes private forestry more challenging for a business that is already struggling. Higher forestry standards can be tried on public lands to see if they have the desired natural resource protections and modified for future regulatory or best management practices. A successful example of this approach is vernal pool BMP's which have evolved in this manner.

e. A landscape mosaic of reserves, early successional habitat and uneven aged forests arranged to meet landscape habitat goals and support the MA Wildlife Action Plan – DCR and other public lands are the only ownerships large enough to affect landscape-scale management.

f. Timber revenues to serve a dedicated local and environmental purpose – DCR timber revenues could be dedicated to serve targeted purposes that benefit local towns and other environmental or educational goals without becoming a justification or incentive for timber harvests.

g. Drive Increased quality of logging, by serving as a model for private forests and helping to drive the production and use of appropriate, low-impact equipment - – Quabbin Reservoir has clearly served this function with logger training and incentives for bringing new logging equipment to MA such as log forwarders in the 1980's. DCR could serve this function also.

2. Please discuss why DCR has chosen not to rely solely on natural disturbances to create a more diverse, uneven-aged forest?

a. As noted in the MA Wildlife Action Plan (page 308): *While it is instructive to examine the historical range of variability associated with natural disturbance regimes (see Thompson and DeGraaf 2001), managers should not seek to re-establish conditions from a previous time (e.g.; prior to European settlement), but rather should seek to secure a range of conditions in today's landscape that will support viable populations of native wildlife species (DeGraaf and Yamasaki 2003)*. In drafting this statement DFW biologists consider the fact that today's landscape condition in MA has never existed before, primarily due to the profound impacts of human land use history. The relatively homogeneous, even aged forest that covers much of our landscape will slowly become more diverse over time due to natural disturbance from wind and ice storms, and outbreaks of both exotic and native insects. Forest management can help move the forest to a more diverse condition that will better support native wildlife. If disturbance occurs on forests where management is planned to help increase species and age diversity, it will help us reach these goals more quickly and will lessen the need for active management in those areas. For example, the slow decline of blocks of hemlock forest that are affected by the hemlock adelgid allows for the development of regeneration as openings occur. Disturbance that occurs in a well-planned and implemented manner will build resilience into our homogeneous forest making it more resilient. The disturbance that occurs via well-planned forest management will also ensure that conditions for a wide diversity of species will occur. Building in this diversity and resilience is increasingly important as climate change may increase the severity and frequency of future disturbances.

b. See the MA Wildlife Action Plan (pages 308-319) for an excellent discussion of disturbances and forest habitat. Pre-colonial disturbance regimes have been altered significantly. For example beaver openings and fire openings are now substantially restricted and these disturbances provided a large percentage of early successional habitats in the pre-colonial forest (WAP page 310). As noted above, the WAP states that there is less early successional habitat now than in pre-colonial times and it is decreasing. Another disturbance regime that was more prevalent in the pre-colonial forest is small canopy gaps created by the death of individual old trees which is less common today due to the relatively young ages of most trees (many trees are $\pm$80 years of age, but individual trees of species such as oaks, sugar maple, yellow birch and hemlock can live for 300-500 years.

c. This approach focuses on increasing a forest ecosystem's "resistance and resilience" across a watershed or other forested landscape. This does not prevent the large natural disturbances from occurring, but in theory it should limit their impact, their intensity (by

increasing resistance) and bring the forest back more quickly after the event has passed (by increasing resilience), simply by diversifying age and species composition.

Suggested reading: Daniel Botkin's Discordant Harmony; Lee Frelich's Forest Dynamics and Disturbance Regimes; Peter Attiwill's article in Forest Ecology and Management (1994; 63:247-300) "The disturbance of forest ecosystems: the ecological basis for conservative management (thanks to Thom Kyker-Snowman of DCR DWSP and John Scanlon of DFW for assistance in this answer).

3. For each of the past 10 years, what is the percentage of Massachusetts' timber harvests that have come from DCR lands? Are these percentages likely to change significantly under the new forest resource management plans, and if so, by how much?

Figures for private land harvesting are only readily available for the past 9 years therefore the comparison is done for the fiscal years 2001 – 2009.

	Total acres harvested	% of Total	MBF Volume harvested	% of Total	Cords Harvested	% of Total
Private	213,326	95	439,417	92	413,199	93
State – BoF	10,831	5	38,137	8	30,041	7
Total	224,157	100	477,554	100	443213	100

If the maximum ceiling levels were reached in the approved plans (450 acres per year for three districts – about 600 for the Central Berkshires District) the increase from the Berkshire Districts would be about 7000 acres over a nine year period or 64% more than the statewide total over the last 9 years.

4. What is the basis for DCR's decision about the amount of early successional habitat to be created each year through cutting in DCR forests? When cut areas are added to similar habitat created by ongoing natural disturbances, what is the anticipated average total percentage of DCR forests available each year for species that require this type of habitat?

a. See #1 and 2 above and MA WAP pages 308-319. The modern landscape has been significantly altered to that of pre-colonial times especially concerning beaver opening, fire openings and openings caused by the death of old trees. As early successional habitat is less than pre-colonial times and is declining and little of this habitat is being provided for on the 80% of the forest that is privately owned; there does seem to be a good justification for providing this habitat on DCR forests. According the USFS, the average removal for harvesting on private forests is 1/3 of the basal area; not enough to often produce early successional habitat. DCR needs to be creative as to how this habitat can be provided in a manner that is acceptable to the public. There are presently less than 2% of early successional habitat on DCR forests (0.4% seedling – up to 10 feet tall and 1.5% sapling – up to 30 feet tall). The Forest Management Guidelines

for Wildlife Management Areas in MA recommends establishing landscape composition goals for Wildlife Management Area forestlands considering habitat requirements for both vertebrate and invertebrate wildlife of 5-10% for early seral (seedling) and 10-15% sapling/small pole (Forestlands on WMAs are presently <1% seedling (dbh <1"), <2% sapling-small pole (dbh 1-6"). According to the WAP the pre-colonial MA forest contained the following early successional habitat by forest type: 10-31% in pitch pine; 3-40% for oak forests; 1-3% for northern hardwoods and 2-7% for spruce-northern hardwoods. Thus, it seems likely that even with DCR and DFW implementing their current habitat goals, the statewide total of 5% early successional habitat will likely still decline.

5. Based on DCR's current land base, what is the maximum number of reserves greater than 15,000 that could be created today? Given DCR's vision of increasing the amount of land in reserves to approximately 250,000 acres, why is a future acquisition strategy preferable to creating the additional reserve areas on currently owned lands?

a. Currently only DCR holdings at Quabbin, Ware River, Wachusett and October Mountain exceed 15,000 acres although Myles Standish is very close to this acreage. The 8 large Forest Reserves designated by EEA in 2006 were based on the rating of 23 candidate sites with 11 criteria developed by a panel of experts mostly outside EEA. The 8 reserves represent the 7 "ecological land units (the ELU system was developed by TNC) where reasonably unfragmented candidate sites still exist. The top-ranked candidate in each ELU was chosen. Two sites (Mt Greylock and Mt. Washington) represent the same ELU and were chosen because they ranked 1st and 2nd of the 23 viable sites statewide. In 2007, EEA developed the Habitat Reserves as a way to focus land conservation funding on the most unfragmented landscapes left in the state. The 10 HR's include land surrounding 6 of the 8 Forest Reserves with the remaining 4 representing a Forest Reserve Candidate (Taconics) and three landscapes in central MA that were not candidates due smaller size and fragmentation (Mt Tom/Holyoke Range, Douglas Woods, and Ashburnham/Mt Watatic). In two years EEA and its land trust partners have protected about 10,000 acres in the HR's. At this rate, we will secure the best and most representative sites before significantly more fragmentation occurs. Given that only one DCR DSPR site exceeds 15,000 acres, it seems land conservation around the highest rated sites where unfragmented land still exists seems like a more targeted approach than to designate ½ of state lands (most likely with an average much lower ecosystem rating than land surrounding existing large reserves). Certainly, there may be a way to maximize a designation and acquisition approach by selecting the highest potential land in representative forest ecosystems.

b. It should be noted that the 3-year Forest Reserve process included 4 public meetings in the vicinity of the recommended large Reserve sites. In addition, EEA staff attended several organizations' annual meetings to gain input and reviewed 300 letter comments. In addition, staff met with 2 town select boards who were concerned with the amount of reserved forests in their towns (and the impacts on future payments). Forest reserve boundaries were changed to meet these concerns. There was overwhelming public support for a balance of reserves and sustainably harvested sites on state-owned lands. For example, of the approximate 300 letters received after the meetings, more than 250

voiced support for the eight proposed large forest reserves and "Green Certified" forest management. Other letters expressed support for the large forest reserves at Middlefield and the Westfield River, support for adding the Jug End property to the proposed Mount Washington forest reserve, support for an added reserve at Mohawk-Monroe-Savoy State Forests, and support for no new snowmobile trails or communication towers in the Mount Washington reserve. All these comments were incorporated in the reserve system.

6. What actions, if any, has DCR already taken to address recent timber harvest planning and/or implementation problems – for example problems with either the site-specific plans or with the supervision and oversight of harvests -- that occurred at some recent timber sales (e.g., Savoy)? What still needs to be done to improve site-specific planning and implementation, and how does DCR intend to address these needs?

The Management Forestry Program of DCR Bureau of Forestry has taken the following actions as new policy to address recent timber harvest planning and/or implementation problems:

a. The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has been asked to survey each proposed timber sale site for priority habitat and rare species prior to the development of site specific silvicultural prescriptions.

b. A detailed site specific silvicultural prescription will be prepared for each proposal. The prescription will be reviewed and approved by the Program Supervisor. The prescription will discuss, among other things, the current state of forest vegetation, how manipulating it fits with the direction of the forest plan, the predicted result/condition of future forest, and how the stand will be harvested (e.g. logging system). See the model prescription developed with Program Supervisor and District Management Foresters being used as direction for the program at: http://www.mass.gov/dcr/news/publicmeetings/forestry/fsnm.pdf

c. A site visit to each proposed harvest area will be offered to the public.

d. Language within the timber sale contract is being modified to strengthen the implementation of the prescription and enforceability of the contract. Examples:
    i. Requirements on machinery to be used
    ii. Operation plans required of purchaser
    iii. Maps (part of contract) fully document stream crossings, wetlands, protected areas, and other important issues

e. Policy on forester oversight is strengthened through regular inspections and filing of inspection reports with the timber sale purchaser (documentation of good and bad) and the Program Supervisor.

f. The filling of the Program Supervisor position is imperative and has been completed. The standardization of forestry across the districts (prescriptions, contracts, harvesting standards, monitoring) is also imperative and in progress to fruition.

7. Based on the existing forest resource management plans, and projecting for areas that don't yet have plans, what is the amount of biomass that will be available for removal each year from state forests?

a. The Kelty, D'Amato, Barten report on the Sustainable Biomass Initiative web site at DOER done in Jan 08 recommends that 465,203 acres of public land (DCR and DFG) is available for biomass harvesting and that 279,866 dry tons/year could be harvested sustainably.

b. Since this report came out, DFG and DCR have completed management plans on several of their properties covering the Berkshires. If the cutting levels in those plans are extrapolated for the entire ownership it comes to a level of cutting on about 4,900 acres per year. In reality, cutting intensities are likely to be lower in central and eastern MA and both DFG and DCR don't currently have the forestry staff to cut at these levels (especially DFG). So this is a true upper limit of what we might expect. The Kelty report gives two volumes for partial cuts for biomass material – one of 9 tons/acre for a thinning of the about ½ of the larger trees and one of about 25 tons/ acre for a thinning of ½ of the larger trees and all of the smaller trees. If you multiply the 4,900 acres by 15 tons per acre (assuming some material needs to be left on site for wildlife and site productivity and the average cut probably won't be that heavy to begin with) = 73,500 tons per year. This is 1/4 of the value published on the web site.

c. It is important to understand that market demand for biomass will never drive the management decisions made on DCR, Bureau of Forestry lands. Based on existing forest resource management plans, management decisions are needs based, as directed by the specific plans. If a timber sale is prescribed and sold under the auspices of an existing plan the purchaser may choose to market those trees cut to the biomass market. This is unlikely in some prescriptions such as small group selections and thinnings that will limit harvesting equipment. The economics of such prescriptions will preclude the opportunity for biomass harvesting.

8. Under the proposed rotations in the approved forest resource management plans, at a point 150 years in the future, how will the average amount of carbon stored per acre on DCR lands change relative to today? Over the same period, how much additional carbon is likely to remain stored in products produced from timber harvested on DCR lands. Please provide a comparable estimate of average per acre carbon storage in 150 years for similar DCR lands already designated as reserves.

a. This question needs some modeling to answer so we would need more time. Perhaps Charlie Thompson or Jonathan Thompson's work may help with this during the TSC process.

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Note: John Scanlon, Chief Forester, Division of Fish and Wildlife, Massachusetts Department of Fish and Game also contributed to this document.